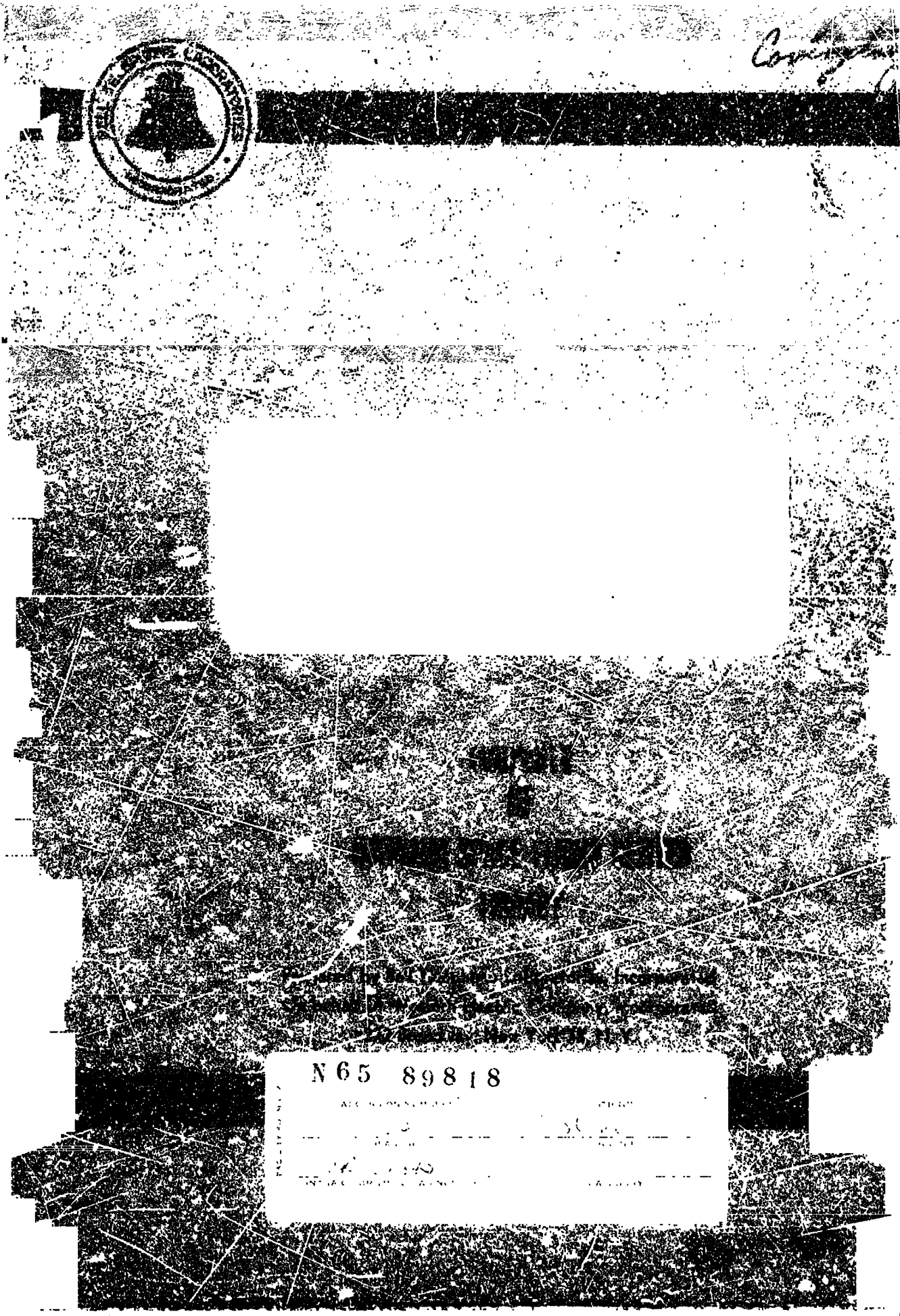

PROJECT MERCURY

REPORT ON OBSERVATIONS OF THE MERCURY GROUND NETWORK DURING THE MNTV-1 NETWORK EXERCISES OF July 25-31, 1961

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National Aeronautics and Space Administration
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I. INTRODUCTION

This report contains the observations made at all of the sites of the Project Mercury Tracking and Ground Instrumentation Range during the network drills preceding the scheduled launching of the Mercury Network Test Vehicle (MNTV-1) in July 1961. The launch was scheduled for July 31, 1961 and was preceded by a six-day countdown starting on July 25 which included two network drills (NCG-378D on July 26 and NCG-378C on July 27). On July 31, the launch was postponed indefinitely because of capsule equipment problems, so that observations of the site performance with the capsule in orbit were not obtained. However, the observations made during the network drills in which the capsule pass over the sites was simulated, are pertinent and are summarized in this report. They were also transmitted orally to NASA at an observer debriefing held at Langley Field, Virginia on August 8, 1961.

The MNTV-1 mission had the objective of demonstrating the acquisition, radar tracking, computing and communication features of the Mercury Ground Range. The MNTV-1 capsule contained one S-band radar beason, one C-band radar beacon, two unmodulated telemetry transmitters, two command receivers and two Minitrack beacons. Its trajectory was to be similar to that of the Mercury-Atlas capsule (although in a higher and more elliptical orbit) so that it would pass over the Range sites. The capsule beacons and transmitters could be commanded to turn "on" and "off" from the ground in order to conserve battery power. This feature would enable the capsule to radiate for three or more days so that it would be tracked by the range, not only on launch (F-0) day but on at least two succeeding days (F+days) for the three orbits when it was in range of the Mercury sites. It was equivalent, therefore, to at least three three-orbit Mercury-Atlas launches in exercising the acquisition and radar tracking equipment at the Mercury range stations.

For this mission, observers from the Bell Telephone Laboratories and Western Electric Company, as well as from NASA, were stationed at all of the range sites. The deployment of the BTL/WECo observers is given in Appendix B. The large number of observers resulted from the need to observe the performance of each radar and acquisition aid at all of the Range stations as well as the performance of the computers and the communications network. The observers were also required to brief the sites on the MNTV-1 mission, because they carried much of the pertinent data on the mission to the site and because NASA Flight Controllers were stationed only at the Mercury Control Center (MCC) and Bermuda (BDA). Revised Brief System Tests (BST's) and Detailed System Tests (DST's) were used during this mission for the first time and comments on their suitability were solicited from the operating personnel at the sites.

The emphasis of the observations, in keeping with that of the mission itself, was on acquisition and tracking. The observer's function was, therefore, to record quantitative measures of acquisition and tracking proficiency, as well as to evaluate qualitatively the site's ability to perform these important functions. In addition, M&O procedures, computer program performance, communications facilities and performance of peripheral (as regards MNTV) equipment, was noted wherever possible.

As noted above, it was not possible to realize the main mission objective of tracking a live orbital vehicle. Accordingly, actual tracking proficiency and ability to engage

in smooth radar and command handover could not be determined. However, some clear indication of potential problems in these areas was obtained from observations of the site response to the simulation. In addition, the data flow from site radars to the computers and from the computers to the sites, and network communications were actively exercised.

II. METHOD OF OBSERVATION

The initial task of the observers was to brief the site personnel on the purpose and conduct the MNTV mission and to describe the site's role in the mission. Fortunately, NASA had prepared quite complte documentation for the MNTV mission which was given to the observers at their initial briefing at NASA, Langley on July 12, 1961. A second briefing was held at WECo, New York City on July 18, 1961.

During the network drills, the observers were located near the acquisition and radar consdles at the remote sites and monitored the appropriate intercom loops as well as the performance of the equipment. Observers at MCC and BDA performed similar functions in the Operations Room and Communications Center as specified in the BTL report, "Plan for Observation of the Mercury Network Test Vehicle (MNTV) Mission" dated June 28, 1961.

Throughout the scheduled range activity, (see Appendix A) observers noted the site performance. Specific network activities were conducted in accordance with countdown documents supplied by NASA and carried by observers to the Sites.

At the conclusion of the simulated mission, a brief Observer Report (Appendix C) was transmitted to MCC. This contained:

(1) Times and coordinates of radar and AAA tracking for each pass, compared with predicted values. Hand-over times where applicable.
(2) Receipt times for AQ messages
(3) Transmit times for SUM messages
(4) A summary of TTY performance
(5) A brief evaluation of the exercise, including difficulties noted and suggested changes.

On August 8, 1961, the observers were de-briefed at a meeting held at NASA, Langley during which specific comments on site performance and recommendations for changes were presented to NASA. This report records these observations and recommendations.

III. SUMMARY OF OBSERVATIONS

The consensus of the observers was that the Mercury Range would have supported the MNTV mission if it had been launched. It was, however, the opinion of most observers that the Range would have benefited greatly from scheduled network drills during which the Mercury orbital missions were simulated. Network drills had not been performed since those conducted during the countdown for the MA-3 mission during April 1961. The only regularly scheduled network exercises were the CADFISS tests which exercised only a small part of the M&O team.

In addition, it was the opinion of most observers that the Range sites were in great need of realisitc tracking experience. Since this function receives the least effective exercise even in simulated drills, (except for BDA, CYI, and MUC, which have VATS and RAZEL equipment and CNV which is experienced with actual launches) it gave evidence of greater weakness. Although actual tracking experience, e.g., with an MNTV capsule, would be most beneficial, the provision of all sites with RAZEL-type equipment would greatly alleviate this suspected weakness.*

The radar handover procedure, which was introduced during the MNTV network drills, was not effectively exercised during these drills since it was difficult to simulate handover in the absence of an active capsule.

Several other shortcomings in site performance were noted. Chief amoung these were unreliable status reporting , and inadequate equipment record maintenance. Equipment and procedural difficulties were uncovered (see Sectio V) but most of these are susceptible to correction.

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*Radar tracking performance during the subsequent MA-4 mission substantiated this observation.

In general, most observers felt that there was a real need for tightening up the operation of the sites to reduce some of the apparent laxity and to instill a conviction of the need for world-wide teamwork if the Mercury mission is to succeed.

IV. RECOMMENDATIONS

In this section a brief statement of each recommendation derived from the observations made during the simulated exercises is given. At the end of each statement, the number given corresponds to the paragraph number in the report where the observation which prompted the recommendation is described.

The recommendations are divided by subject matter into (A) Equipment, (B) Procedures, (C) Personnel and Training.

A. Equipment

1. TTY Communication
   a. Improve the performance of the TTY circuits to CYI, and CTN. V-A-1-a
   b. Remove the intermittent failure of the radar encoding/transmission equipment at WHS which resulted in an occasional transmission of a "BU" instead of "JJ" code. V-A-1-b
   c. The 26RO TTY equipment in the FPS-16 building at HAW should be move upstairs where operators are stationed to enable them to monitor the radar printout. V-A-1-c
2. Voice Communication
   a. Remove the cause of the echo noted at HAW on the GSFC conference loop during test 378C V-A-2-a
   b. Adjust the voice level and clear the noise in the GSFC loop reported by TEX. V-A-2-b
3. Intercom
   a. Equalize the intra-site intercom loop volume at TEX. V-A-3-a
4. Computer Program
   a. Investigate the feasibility of shortening the CADFISS Roll Call program by conducting the test with WOM earlier. V-A-4-a

5. Displays
   a. Install valid radar track lights on radar plot boards as well as an automatic pen-down feature. V-A-5-a
6. Antennas
   a. Provide a modification that will reduce the incidence of recurrent breakage of the high frequency dipole antennas. V-A-6-a
   b. Investigate the use of strapping as a means for avoiding the breakage of screen welds on the frame of the A and AR antennas. V-A-6-b
7. Acquisition System
   a. Reduce the acquisition bus errors noted at HAW and BDA. V-A-7-a,b
   b. Relocate the HIGH/LOW telemetry switch so that it is closer to the acquisition aid operator. V-A-7-c

B. Procedures

1. Countdown

a. Require that the M&O supervisor debrief the operating personnel after every exercise, real or simulated. Provide doctrine and procedures for this M&O debriefing. V-B-1-a

b. Provide a briefing message from MCC routinely at T-6 hours to signal the start of the network operations. V-B-1-6

c. Impress upon M&O teams the importance of complete and accurate status reporting. Assure them that the purpose of such reporting is not to criticize their operation but to help them and the network. V-B-1-c

d. Provide adequate transportation at all sites to accommodate crews arriving on a staggered-time basis. V-B-1-d

2. TTY

a. Keep the Communications Center at all sites open continuously during mission and pre-mission time. (Until this recommendation is implemented, insure that TTY personnel are aware of the limitations of a TTY broadcast message issued while other stations are shut down.) V-B-2-a,b

b. Adopt the DTG convention for TTY messages used in the MNTV mission for all Mercury missions. V-B-2-c

c. When non-CADFISS TTY traffic is permitted during CADFISS tests, restrict the length of such messages to one minute or less. V-B-2-d

d. Insure that all communications carriers are cognizant of the start of the countdown and of critical coverage. V-B-2-e

e. Instruct the TTY monitor at Honolulu to inform the GCC at HAW of TTY conditions (over the voice order wire circuit). V-B-2-f

3. Voice

a. Restrict the number of "talk" buttons simultaneously depressed on the conference loop to 2 at most. Then adjust levels consistent with this condition. V-B-3-a

b. Schedule MCC voice checks of the GSFC loop so as not to interfere with the set up at T-10 minutes of FP-2 voice circuit used for radar handover between EGL, MCC, BDA. V-B-3-b

4. Station Records

a. Insure the maintenance of complete station equipment records during both down-mission and up-mission time. Supply appropriate and uniform forms on which these records may be kept. These should include provision for a history of equipment and component failures, duration of outages, and methods of repair. V-B-4-a

b. Require the formal recording and documentation of all equipment modifications. V-B-4-b

5. Test

a. Devise and implement a test of the EGL/CNV CADDAC data link as part of the Network Count. V-B-5-a

b. In reports from GSFC to the sites on scoring of the CADFISS 81 and 82 tests, omit scoring azimuth and elevation since only range is pertinent. V-B-5-b

c. Install range targets for the radars at HAW and GYM if feasible. V-B-5-c

d. Incorporate the changes in BST's and DST's described in Appendix D. V-B-5-d

e. Establish a schedule for the running of BST's and DST's at sites between missions. V-B-5-e

6. Radar

a. Provide more realistic simulation of the radar handover procedure. Amplify the existing handover procedures to cover more conditions. Provide required communications facilities for exercising handover during network drills. V-B-6-a

b. Provide for the release of the WOM radar from its WRE obligations to participate in MERCURY network drills and site drills. V-B-6-b

7. Acquisition System

a. Investigate possible dangers to AAA equipment if MNP data acquisition procedures are followed. Consider providing personnel other than operator to take data. V-B-7-a

b. Define the best available source of data for the AQ bus. Elaborate on acquisition procedures involving radar, ADC operator, and AAA operator. V-B-7-b

8. Timing

a. Insure that all wall clocks display GMT. V-B-8-a

C. Training and Personnel

1. Procedures

a. Provide a BST/DST to check out VATS and RAZEL simulation gear. Include the status of simulation gear in Status messages. V-C-1-a

b. Provide sites having simulation gear with necessary information to develop realistic and appropriate VATS and RAZEL programs. V-C-1-b

c. Utilize the test aircraft when available, as a simulation device for training. V-C-1-c

d. Schedule regular network and site drills between missions. Require that performance of M&O teams during such drills be reported to NASA/GSC for analysis and comment. V-C-1-d

2. Simulation Equipment

a. Modify the VATS and RAZEL equipments to simulate passes of longer duration than 8 minutes. V-C-2-a

b. Provide sites with adequate instruction manuals for VATS and RAZEL simulation equipment. V-C-2-b

c. Investigate the modification of the AAA equipment, such as reported by BDA to enable sites to cover other TM frequencies, so that non-MERCURY satellites can be tracked for training purposes. V-C-2-c

d. Provide VATS simulation equipment at all sites, and RAZEL equipment at sites having VERLORT radars. Provide RAZEL-type simulation equipment for sites having FPS-16 radars. V-C-2-d

e. Provide separate monitor jacks at the M&O, TM, COMMTECH, AAA, and radar consoles. This will provide facilities for training new personnel at these positions, as well as permitting observers to monitor the loops. V-C-2-e

f. Convert the half-VATS simulation equipment at Town Hill to full VATS equipment. V-C-2-f

g. Insure that the RAZEL simulation equipment and the radar range simulator are properly installed and operative. V-C-2-g

3. Personnel

a. Utilize site drills to help integrate system operations and instill team spirit. V-C-3-a

b. Institute a formalized training program for new operators. V-C-3-b

c. Attempt to improve efficiency and reduce turnover by providing recreational facilities and other inducements at the less attractive remote sites. V-C-3-c

d. Provide some relief for the heavy administrative burden of the M and O supervisor. V-C-3-d

V. RANGE OBSERVATIONS

In this section, the observations made throughout the network during the MNTV-1 network exercises of July 25-31, 1961 are summarized. Comments are subdivided into categories of (A) Equipment, (B) Procedures, (C) Training and Personnel, (D) System Tests, (E) CADFISS Tests, (F) Communications.

A. Equipment

1. TTY

a. During Test 378C, CYI reported below normal TTY operations with both GSC and ATS in the early part of the count which they ascribed to poor propagation. CTN also experienced TTY circuit trouble in both directions, before and during the simulated capsule pass over that site.

In Test 378D, ATS was not able to establish TTY contact with CYI. CYI reported minor TTY troubles while CTN noted that TTY communications were good.

b. A failure in the radar encoding/TTY equipment at WHS resulted in an intermittent transmission of an erroneous "BU" code in the Call Directing Code in lieu of the correct "JJ" code.

c. The 28RO in the FPS-16 building at HAW is downstairs where no operators are stationed. The radar printout is therefore not readily monitored.

2. GSFC Conference Loop

a. A NASA observer stationed at HAW reported an echo on the GSFC Loop during Test 378C. In general, the absence of echoes on the conference loop was notable in comparison with previous exercises. The HAW report of an echo was the only one received.

b. TEX, on Test 378C, reported failure of voice line to GSC from TEX just prior to horizon time of the simulated capsule which lasted until the middle of the pass (approximately 5 minutes). The GSFC loop appeared generally noisy to the radar operator during handover and the voice level was low.

c. The voice line from WOM to Adelaide was out during Test 378C for about 30 minutes during the simulated pass of the capsule at WOM. Bad cross talk also occurred for 20 minutes prior to the pass.

3. Intercom

a. TEX reported difficulty with the intra-site volume level on the intercom loop. TEX attributed their difficulty to dirty relay contacts, but a large part of the problem appears to be associated with unequal headset loading at different times.

4. Computer Program

a. The duration of the CADFISS Roll Call was set by the receipt of responses from WOM which are the last to be received. The time interval of this test might be reduced if the program were rearranged to conduct the WOM tests earlier, concurrently with others.

b. The computer programs were much improved over MA-3 and operated without incident during these tests.

5. Displays

a. At BDA, one plotboard operator is expected to handle both C and S-band radar plot boards during a pass. This is very difficult to do for two reasons:

(1) Both radars are not always in track at the same time, and the pens must be lifted during non-valid track.

(2) The plotboard operator must receive the word by air path that a radar has valid track from another operator. He cannot see the valid track indicator because the ADC operator's head is in the way.

At other sites, where only one radar exists, local valid track indication would also be useful to the plotboard operator.

6. Antennas

a. TEX reported breakage of an hf dipole reflector element on the AR antenna prior to start of NCC 378 series. Breakage of dipole elements is a recurrent trouble owing to their long unsupported mass.

b. Screen to frame weld failures were minimized at TEX by strapping the mesh to the frame at 10 inch intervals by means of steel crate strapping bands.

7. Acquisition

a. It was observed that use of the Electrospan Data Link between Town Hill and Coopers Island at BDA was unsatisfactory for antenna slaving from one location to the other. Extreme jitter in the received positional data was present, apparently the result of cross-talk introduced into the tone signals representing positions. As a consequence, each location was obliged to operate independently without benefit of the tracking data at the other.

b. At HAW, the acquisition slewing bus did not initially meet specifications; it exhibited errors of up to 2° in azimuth between the AVA and AQA antennas. The problem appeared to be caused by the long cable length between locations. [illegible] was somewhat improved by adding synchro [illegible]

c. The observer at KNO reported that the AAA operator had difficulty in selecting the TM frequency channel to be used for tracking because the TMH/TML switch is two cabinets removed from his position.

B. Procedures

1. Countdown

a. Several observers reported that the M&O supervisor made no attempt to hold a debriefing following an exercise. The crews were released locally as soon as MCC released the network (except for Communications watch).

b. HAW reported that as a result of testing of the voice circuit by the communications carrier during the early part of the count, there was no confirmation that the count was, in fact, in progress until T-4:30. A TTY briefing message, sent routinely at T-6:00, would eliminate this uncertainty.

c. There were several instances of equipment troubles which did not appear in the site status reports to MCC. Particularly during simulation exercises when it is felt that non-operation of a part of the system will not compromise a mission, a notification of equipment malfunctions may be withheld by the M&O supervisor.

d. WOM reported a problem in coordinating their transportation schedule with the site activities. The site is located 30 miles from town on a rough gravel road. A bus is used to transport the personnel to and from the site; for this reason it is desirable that scheduled mission start times be maintained. Additional transportation facilities for shift crews, and communication watches would be very desirable to cut down the fatigue of the crews because they would not have to arrive on site until required.

2. TTY

a. A teletype procedural problem was noted at TEX. A broadcast message advising all stations to switch

the time of running DST's was sent by MCC after the Communications Room at TEX had closed down following Test NCG 378C. The message was not received when the Communications Room opened the next day. The fact that it was missing was learned accidentally during a conversation with another site. The message accounting system took no note of it since it was a broadcast message which is not recorded at GSFC.

b. Loading of TTY circuits with administrative traffic was common after sites were opened for communication. If a 24 hour communication watch were maintained at all sites this load would be avoided.

c. The Date Time Group (DTG) convention used for TTY messages in Tests NCG 378, was found to facilitate post mission analysis of TTY information flow.

d. During CADFISS Data Flow Test of Test NCG 378C, when TTY messages were permitted, long messages caused marked interference so that an abnormal number of "Time Expired" results were obtained.

e. HAW reported that the Communications Carrier conducted a test of TTY circuits at the start of countdown during Test NCG 378D. At CYI, on the same day, the communications carrier was not aware of the start of the mission. In both cases the support of the mission by the site was affected adversely.

f. HAW reported that, in at least one case, the HON TTY monitor had stopped transmissions to HAW because of poor propagation and excessive garbling, without notifying HAW GCC that these conditions prevaile .

3. Voice

a. Some observers noted that "Talk" buttons on the GSC loop were sometimes depressed without attendants at

the console, or when the position was not being used to talk from. This would have the effect of reducing the received level on the loop.

b. During Test 378C, GSFC was requested to set up a voice conference loop on circuit FP2 between EGL, MCC, and BDA for radar handover. GSFC was delayed in setting up this circuit because a voice communications check on the GSFC loop was being conducted from MCC at that time.

4. Station Records

a. Most observers reported a lack, at the site, of systematic records for equipment maintenance, both down and up mission time. Histories of equipment and component failures, duration of outages, and methods of repair were largely undocumented. Uniform forms for recording this type of data were not available at the sites.

b. There were reports that some sites had installed equipment modifications without authorization. Some of these modifications do not affect circuits, such as a special TM display chart at HAW; others may actually alter the equipment performance in an undetermined manner. In all cases, such modifications are neither standardized nor uniform throughout the Range. One observer noted that some modifications may have masked weaknesses in equipment design, adjustment, or calibration.

5. Test

a. EGL reported no provision had been made for checking the EGL/CNV CADDAC data link during the countdown.

b. CAL reported that, although it passed the range part of CADFISS Test 81, it was scored as a failure in

Azimuth and Elevation, which is not revelant to this test since its successful Test 41 had already checked the AZ and EL.

c. HAW and CYM reported not having range targets for the CADFISS test.

d. The observers brought back site comments on the revised BST's and DST's. These are given in Appendix D.

e. TEX observer reported that BST's were conducted there on almost a daily basis during non-mission times, and DST's were conducted bi-weekly, as a matter of routine maintenance.

6. Radar

a. Observers at radar sites across the U. S. all reported confusion and non-participation in the simulated radar handover procedure. Operators were uncertain of the kind and extent of voice procedure involved in handover. Each site behaved as though it was isolated without radar overlap with other sites.

b. The WOM observer stated that the FPS-16 radar at WOM is made available to Mercury only on a non-interference basis with Woomera range activities. It was not available for either the NCG 378D or the NCG 378C except for CADFISS tests. The radar crew thereby did not get exercised as a member of a Mercury team. As noted below such exercises are essential.

c. The MUC observer uncovered an error in a weighting factor contained in the instructions for interpretation of the radar printout furnished to all observers. As a matter of record, in these instructions the Azimuth and Elevation weighting

factor for the VERLORT should read 2.7466 x 10^{-3}, the same as for the FPS-16, instead of 5.4932 x 10^{-3}.

7. Acquisition System

   a. KNO reported that data recording procedures required by the MNP Data Acquisition Plan might distract the Acquisition Aid operators and result in damage to equipment, e.g. the possibility of antennas swinging into stops at low deviation angles where the AAA experiences rough tracking.

   b. Observers noted some confusion exists among site operators as to which signal constitutes the "best available source" for the Acquisition bus. It is suspected that acquisition and slaving procedures are not standardized between sites.

8. Timing

   a. Some sites reported that wall clocks were reading in local time and not GMT.

C. Training and Personnel

1. Procedures

a. The BDA observer noted that no formal check-out of the VATS and RAZEL simulation gear is made, nor is status of this equipment reported to MCC.

b. The BDA observer reported that part of the reluctance on the part of the sites to exploit fully the capabilities of VATS and RAZEL might stem from the lack of realistic programs appropriate to the mission being simulated.

c. KNO reported that useful operator training experience was obtained by flying Test Aircraft 232 in accordance with MNTV trajectory.

d. All observers noted the initial difficulties that sites experienced in adjusting to network drills after a prolonged period of no network drills (since April '61). The local site drills called for early in the test NCG 378 count appeared to be performed unenthusiastically.

2. Simulation Equipment

a. Sites equipped with VATS simulation gear were not able to coordinate their MNTV simulation exactly with the capsule pass because of the time duration limitation (8 mins.) presently in the equipment. The MNTV vehicle is in a high orbit than the MA vehicle and is in view for some sites, up to 12 minutes.

b. The BDA observer reported that the instruction manuals for use with VATS and RAZEL equipment are preliminary and need to be improved.

c. BDA has made it possible for the AAA to track "live" non-Mercury space vehicles by a modification which allows the Acquisition Aid receiver to be tuned over a broader band of frequencies.

than is used in Mercury. An external oscillator was substituted for the normal local oscillator in order to provide the correct intermediate frequency. This modification would permit non-Mercury satellites to be tracked at all sites for training purposes provided the frequency of their TM carrier is known.

d. The observers at sites without VATS and RAZEL simulators were unanimous in their recognition of the relative ineffectiveness of acquisition and radar tracking simulation at those sites when compared with sites that had these simulators.

e. Observers found it difficult to monitor the intercom at various positions because all available jacks were occupied by operating personnel. Training personnel would be similarly handicapped.

f. The following shortcoming in the VATS simulation installation at BDA was reported:
"The Cooper's Island and Town Hill Acquisition Aids both use the Cooper's Island boresight tower as the source of RF for VATS simulations. The Town Hill half-VATS has no RF output control. Therefore, when the Cooper's Island VATS RF generator is adjusted for threshold sensitivity of the Town Hill Acquisition Aid, the Cooper's Island Acquisition Aid becomes saturated. An attempt was made to overcome this by inserting approximately 40 db of RF attenuation in each of the RF inputs to the Cooper's Island Acquisition Aid. This fix, however, did not prevent saturation of the preamplifiers, and general degradation of the system response was noted. The alternative of allowing each of the Acquisition Aids to track only TM high or TM low during simulation runs

detracts from realism". The use of a full VATS at both locations would remove this difficulty.

g. The BDA observers reported that the VERLORT RAZEL simulation equipment was inoperative during Test NCG 378. It had not been used effectively since it was installed. It appeared that the VERLORT crew had not become familiar with, nor did they appreciate the advantages of using the RAZEL equipment. In addition, it was noted that the VERLORT range simulator, which can be used in conjunction with RAZEL, was also not operating properly.

3. Personnel

a. Some observers reported an unfortunate tendency toward "insularity" on the part of the operators of particular systems. This attitude was adopted not only toward other systems at the site but also toward the network. Site and network drills as well as missions are required to remove this attitude.

b. There were a few instances where new operators were insufficiently trained. No formalized training program appears to exist for training new men. This is especially important at sites where large turnover exists. The M&O Supervisors, on whom the responsibility for this training rests are often too busy with other matters to implement an effective training program.

c. Observers at the less attractive sites emphasized the need to provide recreational facilities and other inducements to aid morale and reduce turnover.

d. Several observers reported that the M&O Supervisors have become so overloaded with adminsitrative duties that they are forced to neglect their operational functions.

D. System Tests

A new set of BST's and DST's was distributed by the observers to all sites, as appropriate to the site equipment. These tests are listed in Table V-1.

One objective of this mission was to determine the site reaction to the new issue of tests. Comments were solicited from all M&O teams in this connection, since it was impossible for the observers to derive detailed deficiencies, errors, and problems from all areas of test. Test data was also collected at the completion of the tests. All of this original material was forwarded to Mr. G. Burton of NASA for review and analysis. In addition, the more significant site comments are given in Appendix D.

In this section of the report, general comments on the tests are presented, together with some quantitative data to indicate the magnitude of quantities measured.

1. Results of Tests During Countdown

(a) Detailed Systems Tests (DST)

Since comprehensive maintenance procedures are not being followed at many sites, as noted above, the performance of the DST uncovered many equipment faults. This results in extended time required to perform the tests since the equipment must be repaired before the test can be continued. For this and other reasons, such as the revisions of the DST's from previous issues, the data that was collected to evaluate the time required to perform the DST's is only tentative. Moreover, many observers did not obtain the times required to perform the DST's since they were not specifically requested. The data that was obtained is shown in Table V-2. The last column in Table V-2 gives an estimate made by HAW,

TABLE V-1

SYSTEM TESTS

BST NO.	DST NO.	System Tested.
101-1	Not Available	Verlort Radar
101-2	Not Available	FPS-16 Radar
101-3A	Not Available	Verlort Radar Secondary Data
101-3B	Not Available	FPS-16 Radar Secondary Data
101-4A	Not Available	Verlort Radar Digital Data
101-4B	Not Available	FPS-16 Radar Digital Data
101-4C	Not Available	MPQ-31 Radar Digital Data
102	102	Capsule Communications
103	103	Command
104	104	Timing
106	106	Telemetry
107	107	HF Point-to-Point Radio
108	108	TTY
109	109	Intercom
110	110	Acquisition Aid
111	---	Naval Recovery

TABLE V-2

TIME FOR COMPLETION OF BSTs AND DST's

TEST/SITE	BDA	KNO	ZZB	CAL	GYM	EGL	HAW EST. TBL-FREE TIME
BST 101-1							
BST 101-2						1:30	
BST 101-3	1:54						
BST 101-4							
BST 102	2:29			1:00			
BST 103	2:29			0:30			
BST 104	1:47						
BST 106	1:23						
BST 108	0:36						
BST 109	2:10						
BST 110	1:00 1:42	Town Hill Coopers Isl					
DST 101-1				5:00			4:00
DST 101-2						5:30	4:30
DST 101-3					6:00		
DST 101-4							
DST 102		3:00	6:00		4:00		4:00
DST 103				9:00	11:00		4:00
DST 104			2:30		4:00		2:00
DST 106		3:00	8:00		16:00		4:00
DST 108	4:30	3:00			7:00		4:00
DST 109					1:30		1:00
DST 110		2:00	5:00		8:00	5:30	6:30

of the times required to complete DST's if no troubles are uncovered. Because of the wide variety of maintenance problems which arise to delay completion of the tests, this estimated figure, based upon experience with past trouble-free tests, is an indication of the probable minimum test duration. The combination of total time (start to finish) plus a report of the maintenance time interval and the idle time (test equipment occupied elsewhere) would be a better method of reporting and should be incorporated in future system test forms.

The sites differed in their preference for the day in the countdown on which to conduct DST's. Some preferred DST's as close to launch day as possible, which others felt minimum interference and equipment disturbance would result if DST's were performed almost a week in advance. Those sites holding the latter view believe equipment deterioration does not occur rapidly following a DST, and that major degradations would be discerned in the BST's. Table V-3 gives site preference for conducting DST's. Note that HAW and GYM desire a repeat of the DST's; GYM feels two days are required for each set of tests. Many sites agreed that more than one day is required if any serious troubles are encountered.

Table V-4 lists some of the more important parameters measured in DST's. Typical values arbitrarily taken from the data sheets of one site are given.

(b) Brief System Tests (BST)

These tests are scheduled in the Network countdown to be completed as follows: BST-101, -107, -108 complete by T-4:15; all others by T-3:10. To properly schedule the beginning of each BST, prior experience is needed. Since in this exercise, revised

TABLE V-3

SITE PREFERENCE FOR DAY IN COUNTDOWN FOR CONDUCTING DETAILED SYSTEM TESTS

SITE	DAY
CNV	F-4 or F-3
BDA	F-2
ATS	F-5
CYI	F-1
XNO	F-5
WOM	F-5
HAW	F-6, F-3 (repeat)
CAL	F-3
GYM	F-10 and F-9; F-4 and F-3 (repeat)
WHS	F-3
TEX	F-5
EGL	F-4

TABLE V-4

TYPICAL VALUES OF SIGNIFICANT PARAMETERS MEASURED IN DETAILED SYSTEM TESTS

TEST	PARAMETER	VALUE
VERLORT		
Transmitter Power Out (101-1)	Total Loss	49 db
	Average Power	90 w
	Computed Peak Power	270 kw
Magnetron RF Pulse Spec.(101-1)	Main Lobe Bandwidth	2.0 mc
	Total Bandwidth	11.0 mc
Magnetron Frequency (101-1)	Wavemeter	2480 mc
Minimum Discernible Signal(101-1)		106 dbm
AGC Dynamic Range (101-1)		70 db
ACQUISITION AID		
Dynamic Range 110	Sum Threshold TM_1 AZ	158 dbw
	" " TM_2 AZ	157 dbw
	Tracking Threshold TM_1 AZ	157 dbw
	" " TM_2 AZ	155 dbw
	Sum Threshold TM_1 EL	158 dbw
	" " TM_2 EL	158 dbw
	Tracking Threshold TM_1 EL	157 dbw
	" " TM_2 EL	156 dbw
Servo Alignment & Transient Response (110)		
	1st Overshoot CW AZ	2.5 DEG
	Seconds Decay CW AZ	3.2 SEC
	1st Overshoot CCW AZ	2.5 DEG
	Seconds Decay CCW AZ	3.2 SEC
	1st Overshoot CW EL	2.5 DEG
	Seconds Decay CW EL	3.1 SEC
	1st Overshoot CCW EL	3.0 DEG
	Seconds Decay CCW EL	3.3 SEC

BST's were being used for the first time, the local site scheduling was not always appropriate to insure completion at the time required for status reporting in the Network Count. In some cases this led to computer related subsystems still being under test at the beginning of CADFISS. Further experience should eliminate this problem.

Table V-5 gives some representative values recorded in BST's. The dearth of quantitative data in Table V-5 results from the fact that most BST's require only a simple check mark (√) response. Observer comments indicate that consideration be given to incorporating more quantitative recording in the BST's than is now required. The simple check-off list now used lends encouragement to artificial results. For example, it appears that the second BST is not always fully performed.

TABLE V-5

TYPICAL VALUES OF SIGNIFICANT PARAMETERS

MEASURED IN BRIEF SYSTEMS TEST

TEST	PARAMETER	VALUE
	VERLORT	
Transmitter Test 101-1	Magnetron Current	11 ma
	Driver Plate Current	7 ma
	Keyer Grid Current	5.5 ma
Receiver Test 101-1	MDS @ Radar Frequency	105 dbm
	Signal Power Level	102 dbm
	FPS-16	
Receiver Test 101-2	Noise Figure Azimuth	8 db
	" Elevation	8 db
Lock on and Release 101-2	Radar Console	50 db

E. CADFISS TESTS

The CADFISS network tests run during MNTV simulations were generally satisfactory. The program and computer difficulties noted during the MA-3 network tests had largely been corrected. Site readiness, as measured by CADFISS, appeared to be good. Most of the test failures could be attributed to incorrect site procedures or minor, non-radar problems.

The Network Countdown for F-0 day included three periods for running CADFISS tests. These were:

(1) A Roll Call starting at T-4:00 (tests 21 through 25,41,42,81, and 82)

(2) A Data Flow test period starting at T-1:55, consisting of tests 41,42,81, and 82

(3) An option period starting at T-0:40, during which reruns or confidence tests could be conducted.

The F-Plus day countdown, which started at T-4:00, eliminated the Roll Call tests. Reruns of failed or timed out tests were deferred until the next test period. This helped to keep the test duration within the scheduled time.

During the T-0:40 option period on Test NCG 378D a long TTY message was introduced by MCC. This message blocked CADFISS cues, and resulted in several time-expirations. The message was an ISI which was quite important to the conduct of that day's simulation. The decision to introduce it during the CADFISS test was a Flight Controller decision. Had it been deferred until after the CADFISS tests, a network hold would probably have been required to insure that all sites received it prior to T-0.

CAL experienced repeated range target test 81 failures in azimuth and elevation. These were generally due to ground clutter when the Verlort radar was pointed at the range target which resulted in poor tracking in azimuth and elevation. Since the range target test is intended only to test range, failures in azimuth and elevation have no significance and should not be included in CADFISS reports to the sites.

HAW and GYM have no radar range targets. All 81 and 82 tests at HAW and all 81 tests at GYM are consequently scored as time expired. These tests should not be scored for HAW and GYM until they obtain range targets.

During MA-3, most CADFISS runs extended beyond their allotted countdown times. For MNTV, only the first Roll Call for NCG 378D ran overtime (by six minutes), and that was due to a delayed start.

F. COMMUNICATIONS

1. Network Structure

The MNTV-1 missions called for the following communications arrangements on its simulated mission days:

a. For NCG-378D on July 25, the full network with all part-time circuits was called up. However, no critical coverage was requested.

b. For NCG-378C on July 26, the part time circuits were not called up but critical coverage was requested. For this mission LDN, CYI, KNO and ZZB shared use of the -17 Circuit; HON, CTN, WOM and MUC shared use of the -02 (radio) circuit and HAW used the -03 Circuit.

The continuity of service of the circuits and equipment on these two simulated mission days was only fair because the number of interruptions, outages and garbled messages exceeded the number that was normal for the Network. Table V-6 gives the details of the major difficulties.

2. Traffic Analysis

a. Information Flow

The traffic analysis of teletype communications of the MNTV-1 missions was examined for "information flow" between originator and recipient. This is in contrast to the analyses conducted on previous simulated missions in which a study was made of message transmission delays on the TTY network. The distinction is principally in that "information flow" is the more inclusive

TABLE V-6

MNTV-1 MISSIONS

PRINCIPAL COMMUNICATION NETWORK TROUBLES

NCG-378D - July 25, 1961

Teletypewriter

0200Z	USAF-2 Ckt to BDA out throughout this mission because of radio transmitter trouble at Andrews AFB.
0311Z	Poling trouble at CNV
0348Z) 0403Z)	15 mins. ATS Ckt garbling
0540) 0620)	14 mins. Sydney - Vancouver Ckt garbling
0423Z) 0606Z) 0612Z)	Radar Data sent to GSFC computer also inadvertently sent to MCC.
0825Z) 0927Z)	62 mins. Ckt to ATS interruptions
1115Z) 1206Z)	51 Mins. Group II TTY circuits open to CNV-Orlando

Voice

GSC-MCC F.P. #3	Out about 1 hour
GSC-BDA #1274	Out about 10 mins.
GSC-BDA #1431	Out about 1 hour

HS Data (MCC-GSC)

Line #1264 (One of four)	Out about 1 hour

TABLE 6
CONT'D.

NCG-378C - July 26, 1961

Teletypewriter

-17 Ckt - A long time was required to establish operating circuit shared by CYI, KNO and ZZB because of continuous FOX transmissions from CYI. Several hours delay in opening traffic to these sites.

0745Z - 02 Ckt HAW-SYD open 10 minutes

0811Z GYM radar to CNV in error

1112Z - 02 Ckt propagation difficulties

Voice

1114Z Voice to Australia was in and out because of propagation troubles

term which recognizes the message processing in the communication centers at both the sending and receiving end. This includes the time-stamping, tape-cutting and checking, etc. operations. To permit this analysis a directive was issued to all sites that the starting "date time group" (DTG) of their messages should be that of the time stamp on the originator's copy as it entered the communications room. The end DTG was to be that of the time of completion of tape punching and checking (which corresponded to the time of initiation of electrical transmission if the punched tape was promptly inserted in the TTY transmitter).

Tables V-7 and V-8 give the summaries of the information flow analysis for the two mission days. Delayed messages are shown in two categories: those between 5 and 10 minutes, and those exceeding 10 minutes. These compilations show that about three-quarters of the messages were being delivered to the recipient within five minutes of origination. This includes all processing, tape cutting, checking and electrical transmission. "Lost" messages should not occur because of the message accounting procedure which requires retransmissions whenever omitted message numbers are noted. However, some losses did occur indicating that all operators were not following the message accounting procedure.

TABLE V-7

TTY INFORMATION FLOW SUMMARY NCG-378D, July 26, 1961

Station No.	Code	Total Inbound Msgs.	Delayed Msgs. 5-10 Min.	Delayed Msgs. 10 min. or more	Garbled Msgs.	Lost Msgs.	Retrans. Msgs.	Msgs. with delay undetermined	Remarks
1	MCC	153	26	10	0	0	2	15	
2	BDA	153	9	3	2	0	0	0	
3	ATS	61	3	6	0	28	0	0	CKT failure between ATS and RCAC
4	CYI	165	24	2	1	0	0	0	
5	KNO	96	4	2	3	1	0	0	
6	ZZB	87	1	0	0	0	0	0	
7	IOS								No TTY data received
8	MUC	178	25	19	0	0	0	0	
9	WOM	167	68	22	1	0	0	0	
11	CTN	96	18	4	0	1	6	0	
12	HAW								No TTY data received
13	CAL								No records of TTY msgs. were obtained
14	GYM	93	10	0	0	4	0	0	
15	WHS	90	35	3	0	2	0	0	
16	TEK	68	15	0	0	0	0	0	
17	EGL	77	0	1	1	0	1	0	
18	GSF	80	0	0	0	0	0	0	
	TOTAL	1554	336	72	8	36	9	16	
			16%	4.8%	0.5%	2.4%	0.6%	1%	

TABLE V-8

TTY INFORMATION FLOW SUMMARY NCG-378C, July 27, 1961

Station No.	Code	Total Inbound Msgs.	Delayed Msgs. 5-10 Min.	Delayed Msgs. 10 Min. or more	Garbled Msgs.	Lost Msgs.	Retrans. Msgs.	Msgs. with delay undetermined	Remarks
1	MCC	49	10	7	0	1	1	7	
2	BDA	58	4	2	0	0	0	0	
3	ATS	59	7	8	1	0	0	0	
4	CYI	48	7	12	0	1	8	0	
5	KNO	46	0	0	?	5	5	0	
6	ZZB	50	0	1	0	0	0	0	
7	IOS	32	3	3	0	0	0	0	
8	MUC	42	5	5	5	0	0	0	
9	WOM	28	6	2	0	0	0	0	
11	CTN	54	1	14	2	6	0	0	
12	HAW	59	7	2	0	2	[illegible]	0	
13	CAL	62	1	2	0	0	0	0	
14	GYM	49	7	5	1	1	1	0	
15	WHS	54	7	12	0	1	0	0	
16	TEX	34	5	2	0	0	0	0	
17	EGL	45	6	6	0	0	0	0	
18	GSC	12	0	1	0	0	0	0	
	TOTAL	781	76	84	11	19	15	7	
% of	TOTAL	100%	10%	11%	1.5%	2.4%	2%	1%	

b. Sum Messages

Of particular interest is the arrival times of the telemetry summary (SUM) messages at sites. These were considered useful to the recipient if they arrived before midpass (point of nearest approach). The results for Test NCG-378D are given in Table V-9. (It should be noted that the SUM messages for the NCG-378 series (MNTV) were substantially abbreviated over those in a Mercury Atlas mission and hence the preparation time was not typical of a real mission.) Table 9 shows that many sites had the benefit of SUM message information from the next preceding site although the SUM from HAW would be the last one received by most of the stations across the United States prior to the capsule pass.

TABLE V-9

LAST TELEMETRY SUMMARY MESSAGE ARRIVING BEFORE MID PASS FOR SITE

Test NCG-378D - July 26, 1961

SITE	ORBIT I	ORBIT II	ORBIT III
MCC		HAW	CTN
BDA		WHS	GYM
ATS		TEX	GYM
CYI	MCC	BDA	(NA)
KNO	MCC	BDA	ATS
ZZB	KNO	KNO	KNO
IOS	ZZB	ZZB	ZZB
MUC	IOS	IOS	IOS
WOM	IOS	IOS	MUC
CTN	WOM	WOM	(NA)
HAW	CTN	CTN	WOM
CAL	(NA)	HAW	HAW
CYM	HAW	HAW	HAW
WHS	HAW	HAW	HAW
TEX	HAW	HAW	HAW
EGL	HAW	HAW	HAW

NA - Capsule does not pass within range of this site during indicated orbit.

APPENDIX A

Schedule of NCG-378 Tests

Date	Test No.	Type of Test	Lift-off	No. of Passes
July 25, 1961	378E	Site Drill	Local Option	--
July 26, 1961	378D	F-0 Network Drill	0800Z	3
July 27, 1961	378C	F+1 Network Drill	1000Z	1
July 28, 1961	----	Maintenance	Local Option	--
July 29, 1961	378B	DST's	Local Option	--
July 30, 1961	----	Day Off	-------	--
July 31, 1961	----	MNTV Mission Postponed	-------	--

APPENDIX B

Deployment of BTL/WECo Observers for
MNTV-1 Mission
July 25 - July 31, 1961

Site	Observers
CNV	P. Freeman (W) J. Hibbert (B) P. Johnson (W)* J. Zullo (B)
GSC	C. Boaz (W) C. Schramm (B) G. Tolson (W)*
BDA	P. Bearer (B) H. Franke (B) P. Lein (W) R. Wise (B)
LDN	J. Anderson (W)* F. Polkinghorn (B)
ATS	W. Adams (W)*
CYI	A. Crisson (W)* M. Fabian (W)*
KNO	E. Bunney (W)* R. Sheerin (W)
ZZB	R. Palmer (W) R. Small (W)*
IOS	H. Kraus (B) A. Schmigel (W)*
MUC	L. Ferrara (W) H. Barrier (W)*
WOM	F. Habich (W) J. Kocik (W)*
CTN	G. Cheeseman (W)

(B) indicates Bell Telephone Laboratories
(W) indicates Western Electric Co.
* indicates resident at site

Site	Observer
HON	H. Benson (W)* H. Kulp (W)*
HAW	J. Johnson (B) R. Hutchinson (W)* P. Sofranik (W)*
CAL	J. G. Kreer (B) A. Roth (W)*
GYM	J. Baldi (W)
WHS	L. Wolf (W)
TEX	R. Cerino (B) C. Jester (W)*
EGL	N. Higgins (W)

APPENDIX C

Observer TTY Report Format

TO MCC
ADM
ATTN: P. J. JOHNSON

OBSERVER REPORT

SITE_____DATE_____

I. TRACKING

	TIME	AZ	EL	RANGE	TIME	AZ	EL	RANGE
PASS 1								
PRED	___	___	___	___				
RADAR		VERLORT				FPS-16		
VALID	___	___	___	___	___	___	___	___
INVALID	___	___	___	___	___	___	___	___
AA								
CON	___	___	___	___	___	___	___	___
LOS	___	___	___	___	___	___	___	___
PASS 2								
PRED	___	___	___	___				
RADAR		VERLORT				FPS-16		
VALID	___	___	___	___	___	___	___	___
INVALID	___	___	___	___	___	___	___	___
AA								
CON	___	___	___	___	___	___	___	___
LOS	___	___	___	___	___	___	___	___

I. TRACKING (Continued)

	TIME	AZ	EL	RANGE	TIME	AZ	EL	RANGE
PASS 3								
PRED	____	____	____	____	____	____	____	____
RADAR		VERLORT				FPS-16		
VALID	____	____	____	____	____	____	____	____
INVALID	____	____	____	____	____	____	____	____
AA								
CON	____	____	____	____	____	____	____	____
LOS	____	____	____	____	____	____	____	____

HANDOVER TIME	VERLORT FROM	VERLORT TO	FPS-16 FROM	FPS-16 TO
PASS 1	____	____	____	____
PASS 2	____	____	____	____
PASS 3	____	____	____	____

II. ACQ RECEIPT

PASS 1	____	____	____	____
PASS 2	____	____	____	____
PASS 3	____	____	____	____

III. TM SUM TRANSMIT

PASS 1	____
PASS 2	____
PASS 3	____

IV. TTY SUMMARY

	CKT ____	CKT ____	CKT ____
IN			
TOTAL	____	____	____
LOST	____	____	____
DELAY 5-10 MIN.	____	____	____
DELAY 10 OR MORE MIN.	____	____	____
GARBLED	____	____	____
RETRANS	____	____	____
OUT			
TOTAL	____	____	____

V. QUALITATIVE EVALUATION: _____

_____

_____

VI. COMMENTS: _____

_____

_____

VII. SUGGESTED CHANGES: _____

_____

_____

SIGNED: _____

APPENDIX D

Site Comments on Brief and Detailed System Tests
Test NCG 378

A. General Comments

1. ZZB: It was the opinion of the M&O personnel that Issue II of the BST's and DST's was adequate. There were no apparent problems except in the case of the timing subsystem where it was felt that the test requirements were too stringent.
2. IOS: It was stated that Issue II of the System Tests exhibited considerable improvement over Issue I through the deletion of superfluous material and more practical procedures. It was the opinion of site personnel that the significance of DST results was diluted by the four-day interval between DST performance and the scheduled launch day. The opinion was expressed that the System Tests were valid and useful when integrated into a normal Mercury countdown.
3. HAW: It was stated that DST's should be performed no earlier than F-3 day. Also DST's should be performed prior to the start of the series of network drills since the BST's performed during each drill are predicated upon the prior performance of DST's. The length of some BST's caused the site to start the local countdown 1-hour earlier than the typical site count in order to assure completion on schedule.
4. TEX: It was suggested that additional time be allotted for BST's to avoid conflicts in equipment utilization.

B. BST 101

1. BST 101-1, Verlort Radar

a. EGL: A large portion of this BST is not applicable to the MPQ-31 Radar Set.

b. TEX: It should be noted that the power supply and magnetron current values given are for "coder - OFF" operation.

2. BST 101-2, FPS-16 Radar

a. EGL: Transmitter test, item 5, should read 250 KW minimum.

Lock-On and Release, item 1.b, suggests setting IRACQ and FPS-16 threshold to within 10 db of the MDS (for beacon operation) to minimize possibility of locking on noise.

b. CAL: Receiver Test, item 9, should read "BEACON MFC-MGC" instead of "BEACON SFC-MGC", "position to boresight" instead of "lock on boresight", and deletion of AGC voltage measurement.

3. BST 101-3A, Verlort Radar Secondary Data

a. HAW: It was felt that the mission scale factor should be used for scale vector check as the existing check appeared to be redundant.

b. TEX: Section IV, item 1.h, suggests changing channel 4 scale factor to 150 kyds/inch with the P/C converter at 2 M yds. Since channel 4 is not used during the folding-plot operation, this would obviate manual changing of the P/C to 4 M yds. during a pass.

Section IV, item 3.b, typographical error, should end "25-inches above X_2 axis and lock".

Section IV, item 5, if suggestion is approved for item 1.h, this section should be changed to read "radar range set at 1-M yds and the P/C converter set at 2-M yds".

c. GYM: This site submitted a draft of a proposed BST to replace BST 101-3A. This draft will be forwarded to NASA/IRD for evaluation.

4. BST 101-4A, Verlort Radar Digital Data

HAW, CAL, TEX, EGL: All Sites reported extreme difficulty in performing the Static Radar Tests due to the "coarse" granularity of the radar controls when compared to the "fineness" of the digital printouts.

5. BST 101-4B, FPS-16 Radar Digital Data

a. CAL, EGL: Simulated FPS-16 Radar Inputs, step 6, this step was found to be erroneous. No teletype output was obtained when TN23 was removed.

b. EGL: Radar Data Self Test, step 1, switch referred to in second sentence should be "S-102" instead of "3-101".

Radar Data Static Test, add step 6, "Press range Recycle switch on FPS-16 console. Check for octal-4 added to the range MSD character".

C. DST 101-2, FPS-16

The following comments and/or suggestions were made by EGL:

Section 3.1 and 3.2: Sanborn recorder sensitivity should be set to obtain full range of the operating parameters.

Section 3.4.1 and 3.4.2: Incomplete, no range simulator rate given. Suggest a value of 10 K yds/sec. Mode of operation not stated (FPS-16 or IRACQ).

Section 3.7.1 and 3.7.2: Console bandwidth-potentiometers should be set for maximum (fully clock-wise).

Section 3.8: Maximum rate should be noted.

Section 3.9: It was felt that more detailed IRACQ checks should be made. For example, check the scan, modes of operation and interval necessary to acquire the target in each mode, etc.

Section 3.10 and 4.0: Separate boresight checks for angles and range target checks for range.

D. DST-102, Capsule Communications

1. ZZB:

Section 5.1.1.6: Reference is made to a non-existent Figure 13.

Section 5.1.1.8: The phrase "channel 5" should be added.

Section 5.1.2.1: Sentence should read "Repeat test steps 5.1.1.1 through 5.1.1.8 with the following exceptions:".

Section 5.2.1.1: Should read "Figure 1" instead of "Figure 4".

2. HAW: Scheduling of G/A, TM, and AA radiations should be done on a non-interference basis.

Applicable portions of referenced material should be included in the DST.

Provide operators with separate data form to record results.

3. CAL: DST 102-3, instructions and data sheet do not agree. Should specify either signal-to-noise measurement of a fixed amplitude input signal, or the input signal amplitude necessary to obtain a given signal-to-noise value.

E. DST-103, Command

1. HAW: Several portions of the Command DST were not applicable to the dual 10-KW system at this site.
2. GYM: Suggest KY 17A check of frequency of all tone oscillators be incorporated into DST-103.

   Section 5.2.2.0, this portion cannot be performed since the Station Guardian also switches on low incident power. To accomplish this check, an external dc voltage source must be used to simulate reflected power. Suggest Fluke Power Supply or 1.5 volt flashlight cell and a 10-K ohm potentiometer.

   DST-103 should be revised to minimize the number of transmitter switchovers since this action removes all power, including filaments, to the master unit.

F. DST-106, Telemetry

1. CAL: DST-106 should include a measurement of the frequency response and a noise level check of the transmission lines connecting the telemetry console and the telemetry receivers, particularly when the distance separating these two locations is very large.

   Measurement of the signal-to-noise ratio of the receivers between T-6 hours and T-0 would increase confidence in the telemetry system.
2. HAW: The receiver calibration procedure could not be used due to attenuation in the long length of coaxial cable required at this site.

   For MNTV, the preamplifier calibration was accomplished by feeding the signal generator output to the HF test antenna and the receivers were calibrated by feeding the signal generator directly into the receivers.

The DST should include an equipment check list specifying switch positions, light status, etc.

3. TEX: A discrepancy exists between Table III of the DST and the pen assignments listed in Section VII of Mercury Network Procedures.

CET and TORF Trigger Level Calibration checks:- it would be preferable to have the "Set Level" expressed in decomm percentages rather than volts.

G. DST-110, Acquisition Aid

1. HAW: Difficulty was experienced in meeting the Acquisition Data Console indicator specification of 1.5 degrees due to the long line length which apparently introduced a reactive component in the circuit.

Accuracy requirement for the acquisition aid slaving of the Verlort and FPS-16 to the boresight coordinates is believed to be tighter than the system design.

Section 7.2.1 specifies a battery box but gives no instructions on its purpose.

2. EGL: Section 1.0.0.f, should read "Decrease the signal generator output below the AGC threshold and then increase the generator output until the AGC voltage becomes negative".

Pedestal leveling should be checked.

3. GYM: Section 2.e appears to be in error since previous information stated that the VCO deflection should be 5 KC/division.